Commentary

Flawed Gun Policy Research Could Endanger Public Safety

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ABSTRACT

A highly publicized recent study by Lott and Mustard concludes that laws easing restrictions on licenses for carrying concealed firearms in public substantially reduce violent crime. Several serious flaws in the study render the authors' conclusions insupportable. These flaws include misclassification of gun-carrying laws, endogeneity of predictor variables, omission of confounding variables, and failure to control for the cyclical nature of crime trends. Most of these problems should bias results toward overestimating the crime-reducing effects of laws making it easier to carry concealed firearms in public. Lott and Mustard's statistical models produce findings inconsistent with criminological theories and well-established facts about crime, and subsequent reanalysis of their data challenges their conclusions. Public health professionals should understand the methodological issues raised in this commentary, particularly when flawed research could influence the introduction of policies with potentially deleterious consequences. (*Am J Public Health.* 1997;87:918–921)

Introduction

One of the most important recent trends in firearm policy in the United States is the enactment of laws making it easier for citizens to legally carry concealed guns in public. Knowing the effect of these laws on the public's health is critical for both health advocates and policymakers. A recent study by John Lott, Jr, and David Mustard concludes that these laws were responsible for substantial reductions in violent crime.[1] Even before its publication in 1997, the study received extensive and largely uncritical media attention. Proponents of liberalized gun carrying laws have attempted to use the study to influence policymakers. We find Lott and Mustard's conclusions insupportable because of serious flaws in the study, most of which bias the results toward finding crime-reducing effects.

More than half of the states now have some form of so-called shall-issue law governing the carrying of concealed firearms. Under these laws, local authorities "shall" issue a permit to any citizen who passes a criminal history background check and meets other objective criteria (such as a minimum age requirement). By comparison, many states still have "may-issue" concealed-carry laws. As the name implies, under may-issue laws, state officials have considerable discretion in deciding whether to grant a permit, often requiring the applicant to demonstrate some special need to carry a concealed gun. The amount of discretion varies depending on the specific language of the state law. This discretion can also create substantial within-state variation in the issuance of concealed-carry permits, with relatively fewer permits issued in urban areas.

Both proponents and opponents of shall-issue laws believe that the laws have important implications for public health. Proponents claim that arming citizens enhances public safety by enabling potential victims to protect themselves and acting as a deterrent against violent crime.[2,3] Opponents claim that an increase in the number of people carrying guns will increase the lethality of spontaneous confrontations[4] and spur criminals to resort to more lethal means during street robberies.[5]

Research on the effects of increased gun carrying by civilians is incomplete, but the weight of evidence suggests that more gun carrying leads to more deaths. Although criminals are sometimes deterred from victimizing someone they believe to be armed, they are also more likely to carry guns to protect themselves against possibly armed victims.[6] This may explain why robbers are more likely to use a gun in cities where gun ownership is higher, and why robbery homicide rates are higher in those cities.[5] McDowall, Loftin, and Wiersema studied the effects of shall-issue legislation in five cities in three states.[7] They found that shall-issue laws were associated with significant increases in firearm homicides in three of the five cities. They also found that Florida's shall-issue law was associated with an increase in homicides for the state

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as a whole.[8] Although these prior studies have some limitations, given the serious problems with Lott and Mustard's study that we highlight in this paper, there is currently no reason to dismiss the previous research literature.

Lott and Mustard's Study Methodology

Lott and Mustard assembled a data set of crime, arrest, income, and demographic data for each county in the United States for the period 1977 through 1992. Each county was classified according to whether and when a shall-issue law was in effect and was assigned a sampling weight based on its population size. Multivariate regression models were used to isolate the effect of shall-issue laws on the rates of specific types of crime and on unintentional firearm deaths. The authors also examined the relationship between crime and changes in the number of carrying permits per capita more directly in three states for which data on carrying permits were available at the county level.

Lott and Mustard's Findings and Conclusions

Lott and Mustard report that the implementation of shall-issue laws was associated with statistically significant reductions in murders, rapes, and aggravated assaults but, in general, did not affect robbery rates. These findings were relatively consistent across the many analyses reported. The effects of shall-issue laws on property crimes were sometimes positive and sometimes negative, depending on the estimation procedures used. The authors found no association between the adoption of shall-issue laws and unintentional firearm death rates. Of the 21 regression models that directly examined the relationship between changes in the number of concealed-carry permits actually issued and crime, only 2 showed statistically significant crime-reducing effects. Lott and Mustard conclude that shall-issue laws brought about substantial reductions in violent crime but may also have led to some increases in property crime.

Flaws in Lott and Mustard's Study

Lott and Mustard's study is plagued by many methodological problems, most of which are likely to bias results toward finding crime-reducing effects of shall-issue laws. These include (1) measurement error in key variables; (2) failure to control for the complex relationship between shall-issue laws, arrests, and crime (endogeneity); and (3) omitted variables and failure to adequately control for crime cycles.

Measurement Error

The primary explanatory variable of interest, the presence or absence of a shall-issue law, is problematic. Lott and Mustard define a shall-issue law as one requiring that "permits be granted unless the individual has a criminal record or history of significant mental illness. . . ."[1] Applying this definition, the authors identify 10 states that adopted new shall-issue laws during the study period, from 1977 through 1992. The presence or absence of a shall-issue law in these 10 states is the primary predictor variable of interest for the authors' analysis. In the regression equations, the state law variable is assigned a value of 1 as of the effective date of the shall-issue law, and 0 otherwise.

Unfortunately, state concealed-carry laws cannot be divided neatly into just two groups. Some states, like Florida, afford issuing authorities essentially no discretion over who may qualify for a concealed-carry permit—these are pure shall-issue states.[9] Other states traditionally considered may-issue states grant authorities substantial discretion. But some states fall somewhere between these two extremes, creating serious variable classification problems for Lott and Mustard's binary scheme.

Even after changes in their concealed-carry laws, in several states authorities retain some discretion to deny permits to individuals who would otherwise meet Lott and Mustard's definition of a qualified applicant. These states include the inherently discretionary requirement that an applicant be of "good moral character."[10–12] Also troubling, the authors identify Virginia as having adopted a new shall-issue law in 1988. Actually, Virginia did not enact a real shall-issue law until 1995.[13] The potential misclassification of the laws in these states means that Lott and Mustard may not be evaluating a consistently defined intervention.

If shall-issue law status is supposed to reflect the actual prevalence of concealed-carry permits, then the shall-issue variable includes additional measurement error. For example, the prevalence of concealed-carry permits varies widely by county within both shall-issue and may-issue states. Some counties within may-issue states have a higher number of concealed-carry permits per capita than some counties in shall-issue states. Again, the law present/law absent dichotomy obscures substantial differences. These misclassifications of the laws and of the prevalence of handgun carrying permits introduce errors of uncertain direction into Lott and Mustard's estimates.

Endogeneity

Lott and Mustard's other prominent explanatory variable is the arrest ratio—for a specific type of crime, the ratio of arrests made to the number of crimes committed. The rationale for including arrest ratios as explanatory variables in the models may seem reasonable—to account for between-county differences in the risk of arrest that individuals face if they commit a crime. But, as has been well known since a 1978 report by a National Academy of Sciences panel of experts, using arrest ratios as predictors of crime rates will lead to biased results.[14]

This bias occurs because arrest ratios are simultaneous (or endogenous) with crime rates, rather than independent precursors. Changes in crime levels produce changes in arrest ratios just as changes in arrest ratios produce changes in crime levels. In this case endogeneity cannot be avoided because the numerator for crime rates is the denominator of the arrest ratio variable. Because of this inherent connection, unaccounted-for factors that influence crime rates will also affect arrest ratios. These unmeasured determinants of crime rates produce the error term in the regression models. When arrest ratios are used as predictors of crime rates, the arrest ratio variable will therefore be correlated with this error term. This produces bias not only for the effects of arrests, but for all variables in the model.[15]

The causal connection between adoption of a shall-issue law and changes in crime rates is also likely to be bidirectional and thus produce endogeneity bias. Lott and Mustard report that shall-issue laws tend to be passed when crime is increasing, perhaps in response to growing fears of crime.

Lott and Mustard acknowledge the problem with both of these key variables, but they attempt to control for endogeneity in only a few of their many regression models. But these "corrected" models are themselves fundamentally flawed. The authors attempt to correct for the endogeneity of arrest ratios and shall-issue laws

by using two-staged least squares regression, but it was determined nearly 2 decades ago by the same National Academy of Sciences panel of experts that the variables used in the two-staged least squares models to identify the effects of shall-issue laws are likely to produce biased estimates.[16]

Omitted Variables and Inadequate Control for Crime Cycles

Crime rates tend to be cyclical, with predictable declines following several years of increases. These cyclical trends are, in part, caused by changes in variables that Lott and Mustard used in their analyses, such as population demographics or per capita income. But crime cycles are also driven by variables not adequately captured in the analyses, such as poverty and changes in the criminal justice system (beyond shall-issue laws and sentence enhancement for crimes committed with guns). These unmeasured changes in the criminal justice system are likely to be implemented in response to fears of rising street crime and, therefore, likely to coincide with the implementation of shall-issue laws. If these coincidental changes in the criminal justice system reduce violent crime, Lott and Mustard's shall-issue estimates will be biased toward finding crime-reducing effects.

A reanalysis of Lott and Mustard's data by Black and Nagin revealed that, just prior to enactment of shall-issue laws, crime rate trends in shall-issue states commonly deviated from trends in other states, and that Lott and Mustard's models fail to explain these deviations.[17] This suggests that factors not included in the models were influencing crime rates in shall-issue states around the time that the laws were being implemented.[17] For example, Ludwig found differences in poverty trends between shall-issue states and other states during the period in which many states adopted shall-issue laws. Ludwig noted that Lott and Mustard used inadequate measures of poverty in their analyses, and he demonstrated that these inadequate measures biased their results toward finding crime-reducing effects of shall-issue laws.[18]

To derive nonbiased estimates of the effect of shall-issue laws, one must control for fluctuations in crime that are unexplained by other variables in the model. Standard techniques for controlling for temporal patterns in model residuals are well known,[19] but such techniques were not used by Lott and Mustard.

Implausible Findings

Studies that rely on flawed statistical methods and data that are vulnerable to significant measurement error are prone to implausible findings. For example, relative to other demographic groups, young Black males have a very high rate of criminal offending and victimization, and older Black females have much lower rates of offending and victimization.[20] But Lott and Mustard's results indicated that the proportion of young Black males in a county's population was only weakly associated with higher rates of crime. The proportion of Black females over age 65 in the population, however, had large positive effects on murder and auto theft while also having significant negative effects on all other violent crimes.

More important than these inexplicable findings is the divergence between the authors' findings and established criminological theory and research. If shall-issue laws reduce crime, one would expect that the largest effects would be on robberies and homicides in which the victim is a stranger to the offender. Of all violent crimes, robberies are most likely to involve predatory criminals victimizing strangers in public places. Yet Lott and Mustard rarely find statistically significant effects of shall-issue laws on robbery rates. Both the two-staged least squares models and the models that directly measured changes in the number of concealed-carry permits issued showed no significant effects of shall-issue laws on robbery rates. The implementation of shall-issue laws also had no effect on the percentage of homicides that involved strangers.

Lott and Mustard report that the strongest deterrent effects of shall-issue laws were actually seen for crimes that are less likely to involve predatory criminals in public places, such as rape, aggravated assault, and murder. Most rapes, however, are committed in homes by someone known to the victim.[21] Aggravated assaults also usually involve people who know each other,[21] and only 15% of murders in which the circumstances are known are the result of predatory crimes (e.g., robbery).[22]

Lott and Mustard also conclude that shall-issue laws led to *increases* in rates of larceny and auto theft. They explain this overall pattern of results by arguing that criminals substituted property crimes, which do not involve contact with victims, for violent crimes. This explanation, of course, does not comport with criminological theory, because theft is the motive for only a very small fraction of the violent crimes for which the authors report shall-issue effects.

Subsequent Research Challenging Lott and Mustard's Conclusions

As mentioned above, two independent studies of the effects of shall-issue laws, using formal statistical tests, raise serious doubts about Lott and Mustard's model specifications. Black and Nagin used Lott and Mustard's data and general regression model but disaggregated the shall-issue law effects for each of the 10 states and found no consistent evidence of deterrent effects for violent crime. When Florida—a state in which Lott and Mustard's models failed tests of statistical adequacy for each of the four violent crimes analyzed—was removed from the analyses, aggregate effects on homicides and rapes vanished. Ludwig[18] assessed the effects of shall-issue laws on state murder rates and found that, after crime cycles and changes in poverty were controlled for, shall-issue laws were not associated with changes in murder rates.

Conclusions

We believe the flaws in Lott and Mustard's study of shall-issue laws are so substantial, and the findings so at odds with criminological theory and research, that any conclusions about the effects of shall-issue laws based on this study are dubious at best. Some of these flaws involve complex statistical issues that are difficult to elucidate for policymakers, the media, and the public. It is easy to see how readers could be convinced that Lott and Mustard's study "proves" that shall-issue laws reduce crime. A large data set was used for dozens of regression models, some of which controlled for "up to 3200 variables" (J. R. Lott, Jr, in an interview on National Public Radio's *Morning Edition,* September 23, 1996). Data consistent with the authors' hypotheses are highlighted, while data that do not support a deterrent effect of shall-issue laws are ignored. Lott and Mustard dismiss *some* of the criticisms raised in this article by claiming that after their models are altered to respond to the particular problem, the results are substantially unchanged. How-

ever, they never *simultaneously* adjust their models to address all of the problems we and others have identified.

However esoteric the methodological issues, the potential impact of Lott and Mustard's study on policy, and ultimately on public safety, is very real. Advocates of liberalizing concealed gun carrying laws, including Lott, are using this study to persuade policymakers to loosen carrying restrictions in states without shall-issue laws. Previous research suggests that more gun carrying by civilians may lead to more deaths.[5–7] It is important for public health professionals to understand the relative merit of studies that could influence the introduction of potentially dangerous policies and to effectively communicate their conclusions to policymakers and the public. □

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